SAVANTS MAKE RESEARCHES IN HIGH ROCKIES

European and American Geographers Study Formations of Towering Mountain Peaks in Colorado.

DIVIDED IN THEORY ABOUT METEOR CRATER

Interesting Phenomenon in North Central Arizona Subject of Much Discussion; Pleased With Salt Lake.

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DENVER, Colo., Oct. 12.—In Colorado, the members of the American Geographical society's transcontinental excursion reached their highest altitudes. They walked over Hagerman pass, which is nearly 12,000 feet above sea level, and which is the dividing line between the waters flowing westward into the Pacific ocean, by way of the Colorado river, and those flowing into the Gulf of Mexico through the Arkansas and Mississippi rivers. Their train then passed within a few miles of Mount Massive and Mount Elbert, which are the culminating points of the Rocky mountains in the United States, and by a remarkable coincidence, are of the same elevation, 14,402 feet, as nearly as can be determined by the most careful measurement. The next day they started from Denver on the Moffat railroad and ascended to its highest point, Corona, 11,660 feet above the sea, from which they climbed to a neighboring peak on the continental divide, at an elevation of more than 12,000 feet.

At High Altitudes.

As the party included in its ranks men who had climbed and studied mountains in all quarters of the globe, the days spent in the high country of Colorado were full of interest and enjoyment, and there were many comparisons made between these mountains and the elevated regions in other parts of the world. Professor Emile Chaix, of the University of Geneva, who was formerly president of the Swiss Alpine club, and who is one of the strongest pedestrians in the party, found the climbing easy as compared with many of the ascents he had made in his native land. He said that the Colorado mountains he had seen have gentle slopes and rounded forms compared with the Swiss Alps, which have steeper slopes and sharp and serrated tops. In Switzerland we could not have climbed to the heights we reached here without using our hands as well as our feet, and being aided by a rope as well.

The Colorado highlands have large plateaus, whereas the level places in the Swiss mountains are small in extent and are often used as pastures for cattle and goats. These mountain fields and meadows are called "alps" by the Swiss peasants, who have little interest in the rocky and snowy summits, and this word has been transferred to the mountains themselves until now it is applied to mountainous regions in general.

High Timber Line.

In Colorado Professor Chaix was struck by the elevated tree line. The trees grew almost as high as we climbed, whereas in Switzerland they reached hardly half that elevation. He believed, however, that the Swiss tree line had been artificially lowered, for the herders on the elevated pastures, or "Alps" had cut down the trees as they needed wood for fuel, and naturally took those that were nearest at hand, or which were above them and could be easily rolled down, and so in the course of centuries, the upper forests had been gradually cut away. Stumps were still found on the bare mountain sides, showing where trees had formerly grown.

Another aspect of the Colorado mountains appealed to Herr Geheimrath Joseph Partsch, the eminent professor of geography at the University of Leipzig. He was astonished at the enterprise and engineering skill of the men who had built the railroads in, through and over the Rocky mountains. The heights there railroads reached were amazing to a foreigner, and far surpassed anything attained by the standard steam railroads of Europe.

Railroads Amaze Scientists.

Comparing them with roads in about the same latitude abroad, he said that in the Pyrenees, between France and Spain, the only railroads were built close to the seacoast on the east and the west, where the elevations were very low, and that there were no railroads at all in the central higher Pyrenees. Even in the Alps, the great railways pierced the mountains by tunnels, at elevations of only a few thousand feet, while in Colorado several of the main lines reached heights of from 10,000 to 12,000 feet, and the Rockies were crossed and recrossed many times by the steel rails.

Professor Partsch thought that the elevated situation of some of the big mining towns, such as Leadville and Cripple Creek, had promoted the construction of the mountain railways of Colorado, but even without this incentive, several of the railroads attained extraordinary altitudes. He had doubts, however, about some of the economic aspects of the Colorado railway situation. He wondered if so many railroads in a new and thinly populated country could pay, and he thought that the high mountain roads, with their heavy grades and sharp curves, must be very expensive to operate. Instead of spectacular "loops" and "horseshoe" curves, winding up and around the mountain sides, he believed that commercial considerations demand the construction of tunnels at lower elevations.

In Europe, he said, they make a point of securing low grades by the use of tunnels, and after building a road up to both ends of the projected tunnel, they keep traffic moving over the mountains by means of a cable railway, or some other temporary expedient, while the tunnel is being constructed. In America they seem more apt to run the main line right over the mountain, but even here there is a growing tendency now to build tunneds, and he had noticed that at Hagerman pass, an old tunnel near the head of the pass had been abandoned in favor of one considerably lower down, thus saving a long length of track and a very severe climb for the engine. He was informed that there is a project before the legislature to have the state of Colorado build a tunnel through the main range of the Rockies near James' Peak. Theoretically this tunnel would be open to any railway in the state, but practically, as it is directly on the line of the Moffat road, the latter is the only one which could use it.

Impressed With Zion.

Salt Lake City and Denver were visited just before and just after passing over the Rockies, and both made an excellent impression. At the former a stop of over two days was made and the visitors had a chance to see the city and the surrounding country. The foreigners were especially pleased with the very clean, wide streets and, with the pure, dry air, and as many of them are music lovers, they took great delight in an organ recital which was given in the Mormon tabernacle.

At Denver only a few hours could be spent, and the weather was not favorable, which is unusual for that city of sunshine, but, nevertheless the brilliant illumination of the streets and buildings and the evidences of prosperity and healthy growth and metropolitan life which were apparent on all sides convinced the visitors that Denver was very much "on the map."

Meteor Crater Interesting.

One of the most interesting objects in the Southwest, and one which has given occasion for a great amount of scientific discussion, is the so-called Meteor crater, in northern central Arizona. This natural phenomenon is a great pit nearly circular in shape and about 4000 feet in diameter. Its bottom, which is more or less level, is at an average depth below the rim of 570 feet, and the top of the rim is about 100 feet above the surrounding country, which is a rather level rocky plain with a very thin covering of soil. The upper stratum of rock in the immediate vicinity of the "crater" is red sandstone, horizontally bedded, and underneath this are stratas of limestone and sandstone. When the crater was formed, by whatever means it may have been, these level rock beds were dislodged from their position and thrown up in the great mass which now forms the ridge around the pit, and whose weight has been estimated at more than 300,000,000 tons. Thousands of pieces of iron, supposedly meteoric in character, and of all sizes up to nearly a ton in weight, have been found within a radius of five miles of the crater, the larger number of them within a mile or two of the rim, but so far only small fragments of iron have been found by drilling within the crater itself. There appears to be no volcanic material within a distance of nine miles from the pit.

Hole Made by Meteor.

All these facts have led to the theory that the great hole in the ground was made by the impact of a meteor, perhaps solid, but more probably composed of a cluster of thousands of meteorites, the greater part of which are now imbedded hundreds of feet deep in the southern part of the pit, or under the southern wall, which is more displaced and which has a larger amount of dislodged material than any other part of the rim. This view is held by D. M. Barringer, who has devoted years of study to the Meteor crater, and who was the host and guide of the American Geographical society's party on its visit to this interesting spot.

But many of the geographers could not agree with this theory, and had opinions of their own concering the origin of the pit. Professor Eugene de Cholnoky, of Kolozsvar, Hungary, who has individual ideas on most subjects, started off on an independent investigation as soon as he arrived on the ground, and found beds of travertine on the western side of the rim, and other material which is associated with deposits made by hot springs.

Takes Different View.

Judging by this, and also by the positions of the beds of rock, both those which had been uplifted and those which composed the top of the plain outside, he came to the conclusion that the pit had been made by a steam explosion, or a geyser on a gigantic scale. After the explosion the siliceous deposits from the geyser had covered the dislodged rocks to a great extent and protected them from being worn away, while the surrounding plain had been eroded down some distance below the ancient level. After returning to the train, he was greatly pleased to discover that W. D. Johnson, of the United States geological survey, had also found travertine on the eastern side of the ridge between one-quarter and one-half mile from the edge of the rim and had very much the same general opinion as to the cause of the formation of the pit, believing that water in the interstices of the underlying rock had been heated to the boiling point by volcanic action still farther down, until the accumulated steam burst out in the grand explosion which made the crater. The lava or other volcanic material itself was so far down in the depths of the earth, however, that no traces of it had been found.

Parallel in Wurtemberg.

In support of this hypothesis, Professor Edward Brueckner, of the University of Vienna, told of an enormous pit or caldera at Ries, in Wurtemberg, in the Swabian Jura, which is about twelve and a half miles in diameter, and between 1000 and 1300 feet deep. There is no volcanic material there, either, but the dislodged blocks of granite, gneiss, and so on, which form the surrounding rocks, indicate pretty clearly that the force causing their displacement must have come from below and was probably due to a geyser-like steam explosion.

Professor Chaix, on the other hand believed that if there had been big enough temperatures to boil the water in the sandstone rocks, the rocks themselves would have been affected, and would show some signs of their heat treatment, and he also thought that if the internal fires of the earth had been the ultimate cause of the explosion, some traces of volcanic action would be visible at, or near, the surface. On the whole, therefore, he was inclined to the meteoric theory.

Professor J. F. Niermeyer, of Utrecht, raised the point that if the hole had been made by a cluster of meteorites it would not be circular, but would be elongated, as the meteorites would strike the earth in a long path, owing to their own and the earth's motion. He also called attention to a paper by Professor M. E. Mulder, of Holland, which had been published about a year ago, and which treats of the explosion of meteors in general, and of the origin of Meteor crater in particular. His theory is founded on observtiona made by Albert Kapteyn on aeroplanes and projectiles, where it has been found that there is a maximum pressure on the forward end and a minimum pressure sometimes amounting to a negative pressure, or outward pull, at certain parts of the sides. Professor Mulden believes that meteors which are in a plastic condition owing to their great velocity in the earth's atmosphere, are hollowed and often exploded by these differences in pressure.

Holds Meteor Theory.

With regard to the Meteor crater phenomenon, he thinks it was due to a great meteor which has hollow, but whose walls were strong enough to resist explosion until it struck the earth. It penetrated the upper standstone and limestone strata, but in doing so its internal pressure was increased so that it exploded with terrific force, causing the uplifting of the rocks, and scattering its own fragments in a wide ring about the pit.

No definite conclusion regarding this most interesting phenomenon could be arrived at, and it seems that the only way to settle the question is to have a large number of deep borings carefully made in the crater, through the rim, and in the surrounding country. It is to be hoped that this will soon be done in the interests of science.